The Phoenix Mission:

the First Arctic Explorer on Mars

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The Phoenix Logo Combines the Themes Of Fire and Water

Designed by
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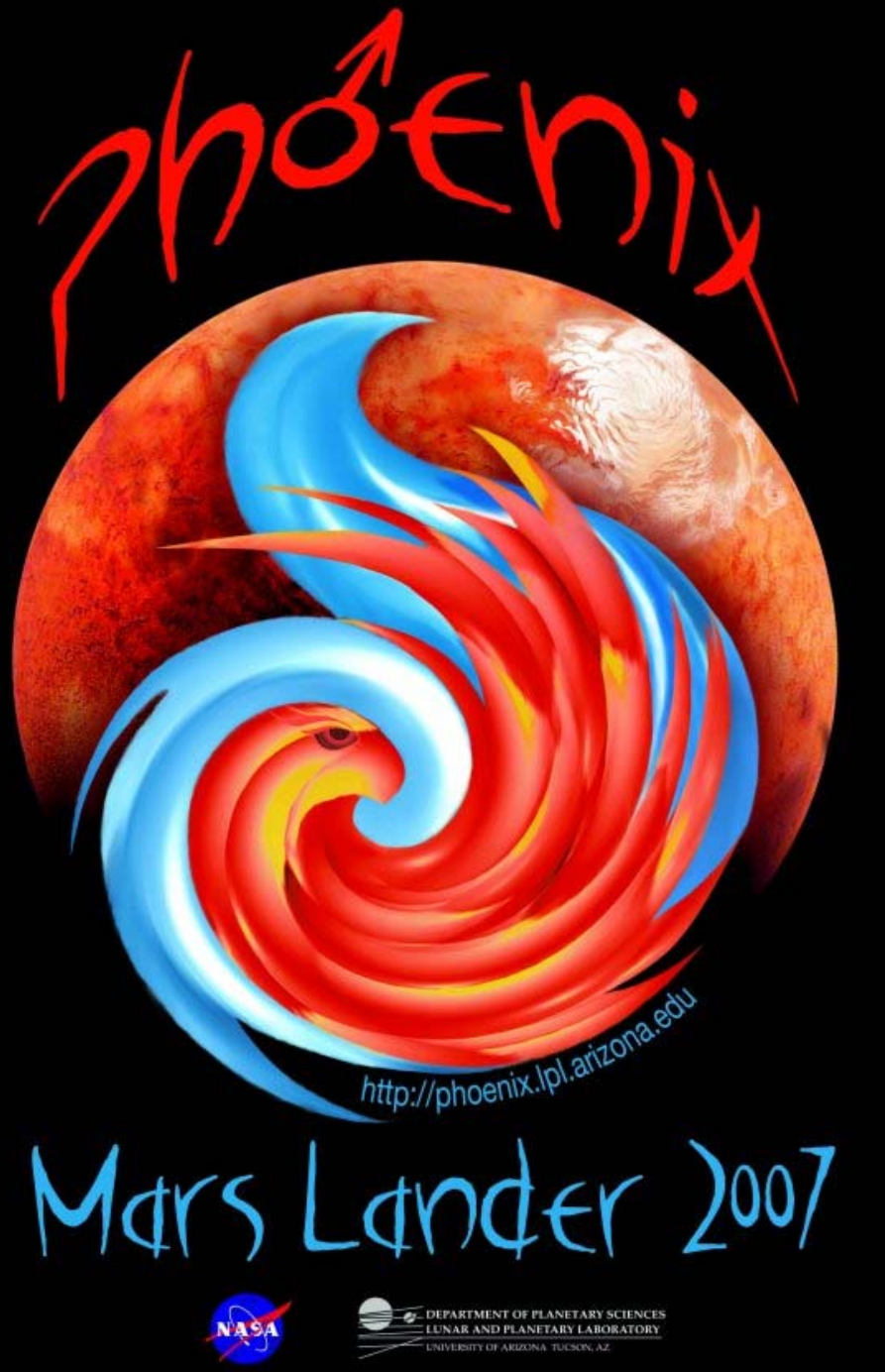
Montreal

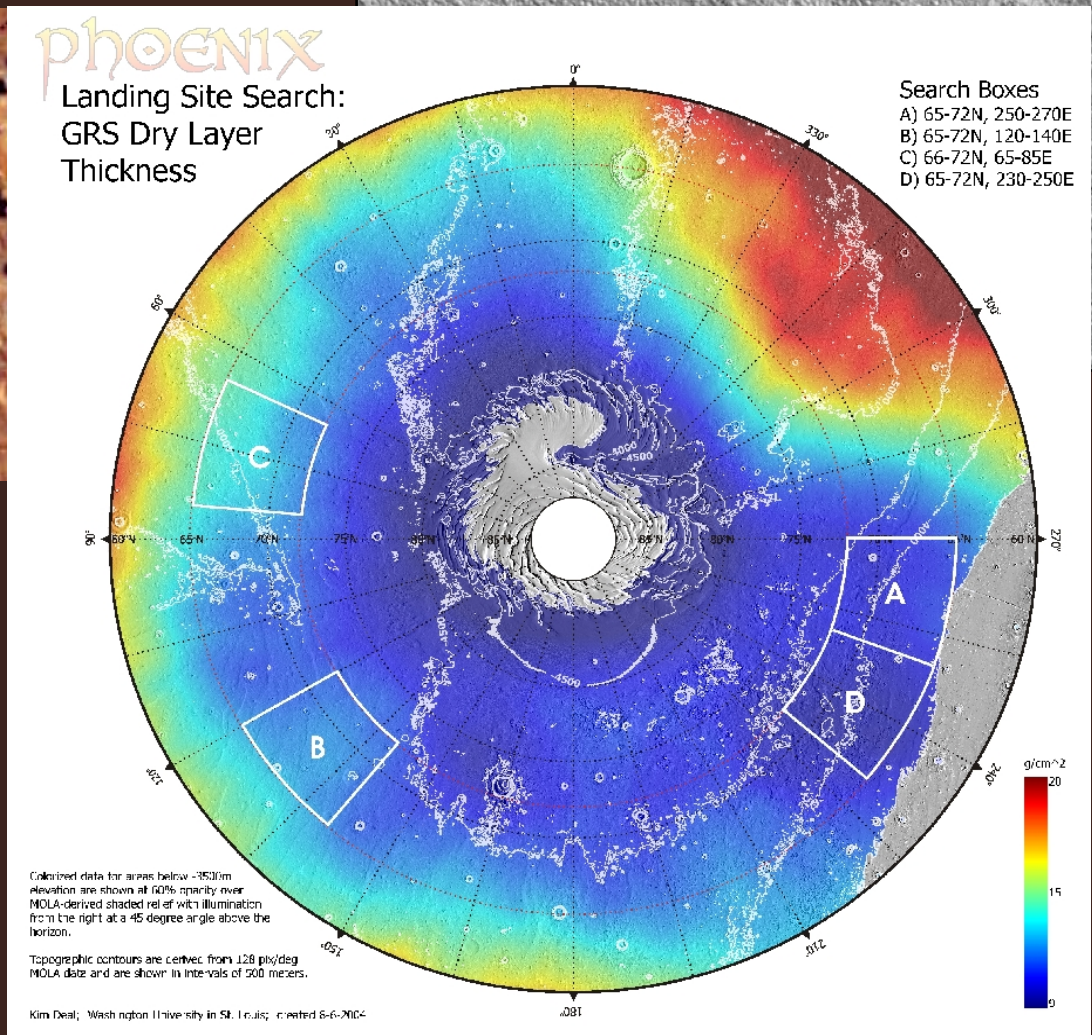
http://phoenix.lpl.arizona.edu



Phoenix Landing Zone

on Ice Fields Discovered by Odyssey

Region B, too rocky



Region D,

Just right

The Big Questions

What happened to the Martian water?

Phoenix will be the first mission to touch and examine water on Mars

Is there biological potential at the northern polar region of Mars?

Three components necessary:

Water ➔ Did the ice melt?

Food ➔ Nutrients and organics

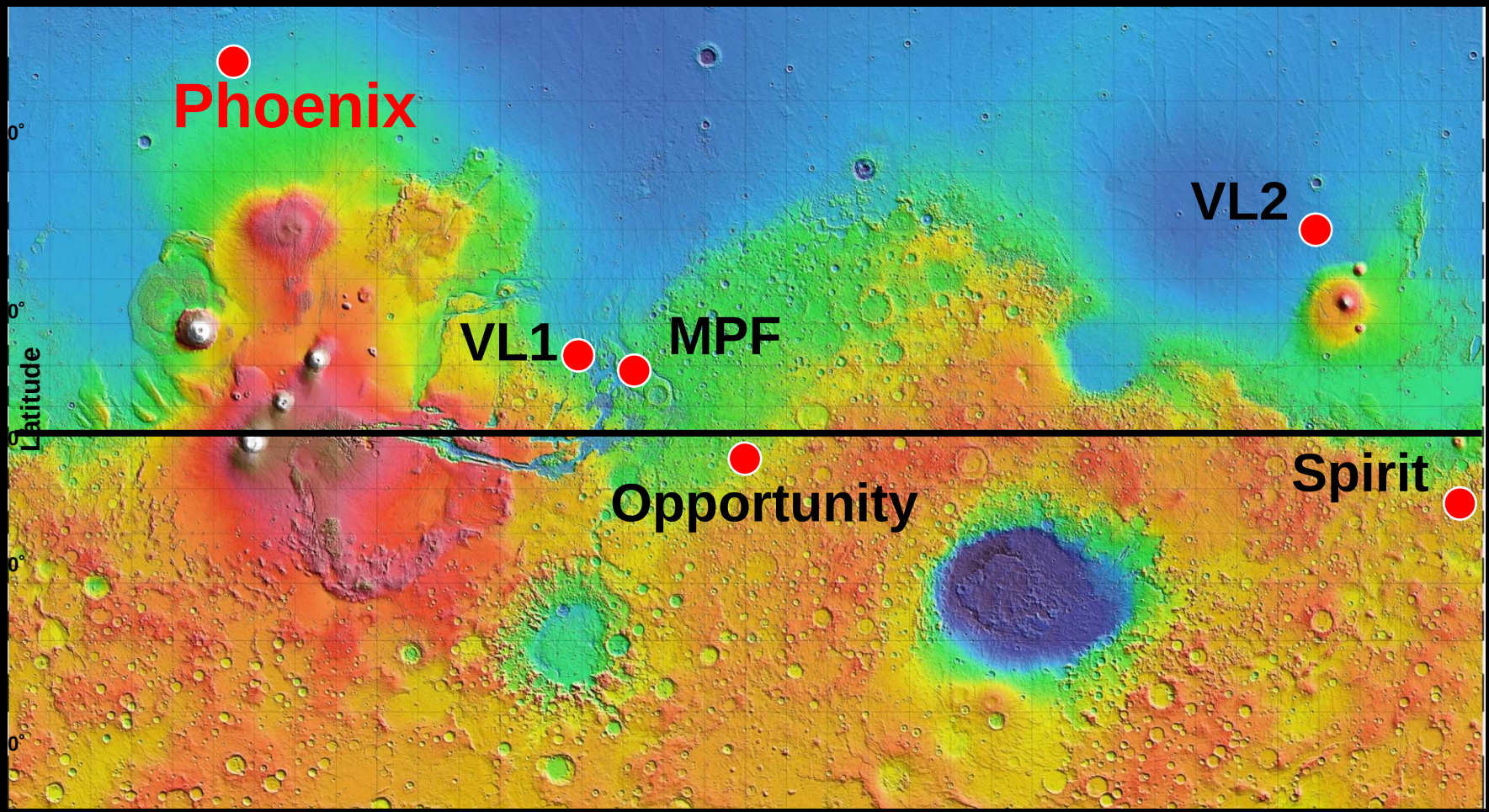
Energy ➔ Solar or chemical

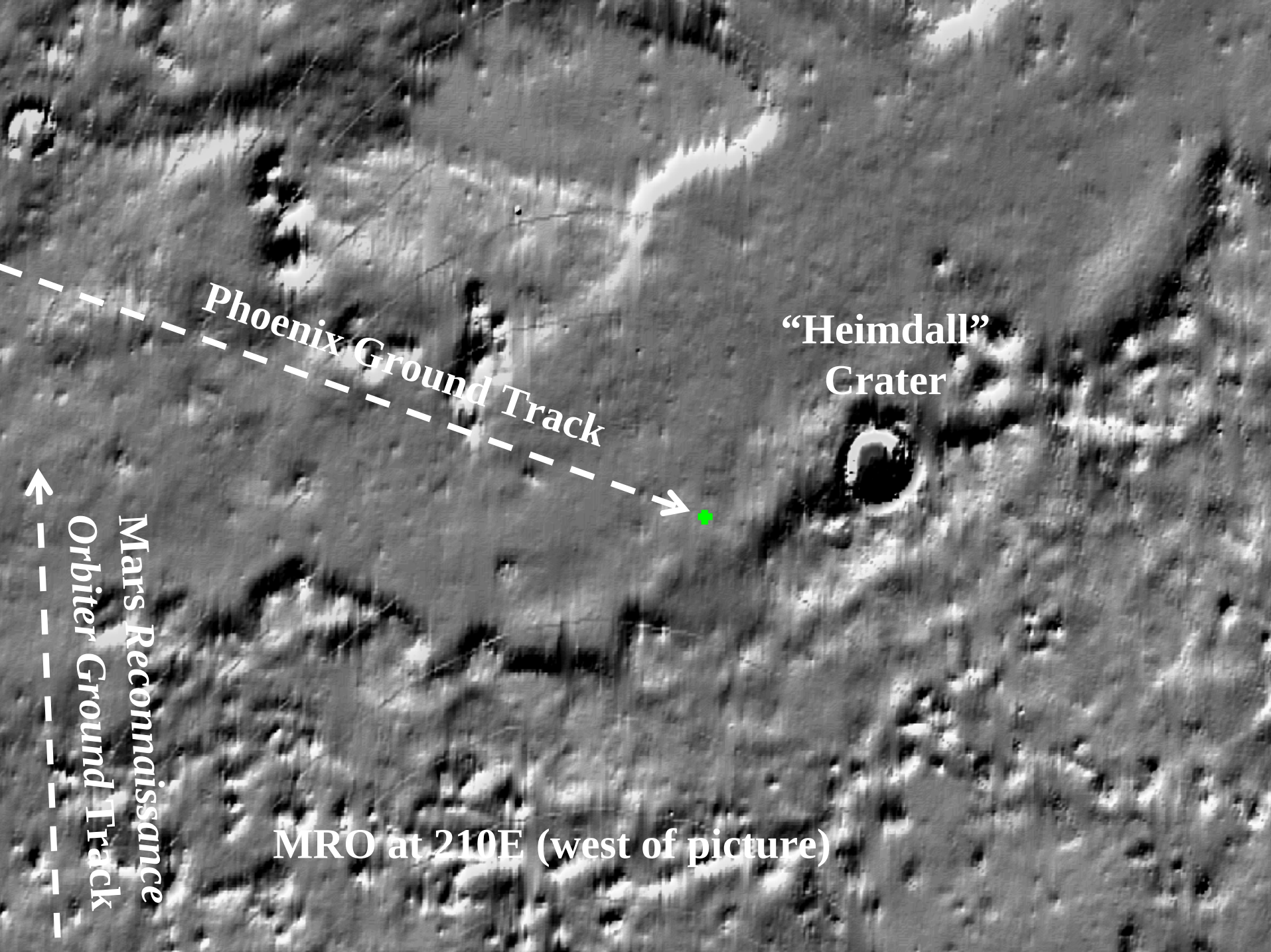
Do the poles indicate global climate change?

Global climate change is dominated by polar processes

Ancient Mars?

Phoenix Landing Site Is Much Farther North Relative to the Other Landers




Phoenix Ground Track
"Heimdall" Crater
Mars Reconnaissance Orbiter Ground Track
MRO at 210E (west of picture)

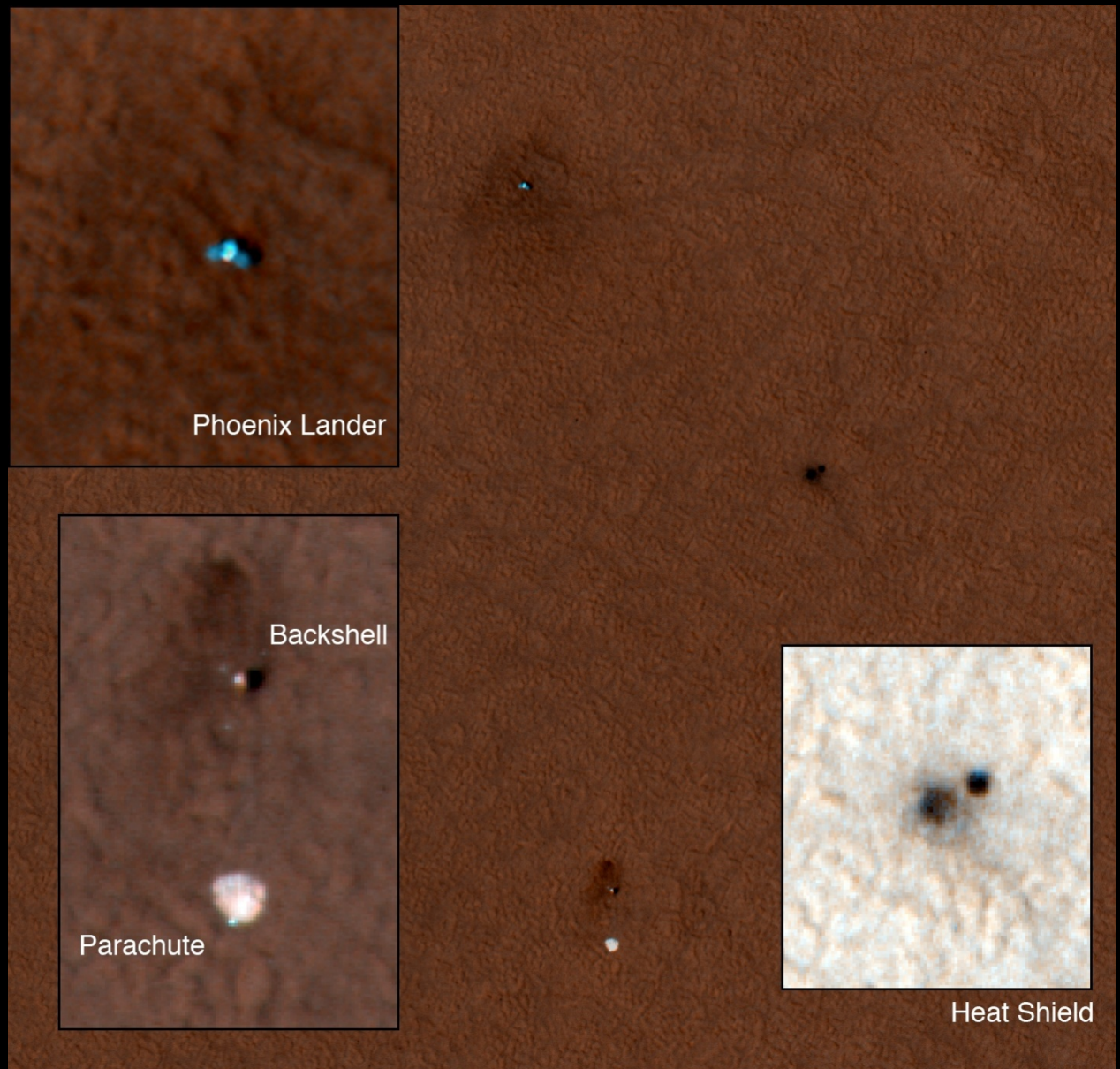
Why Are These People Concerned?

Phoenix: May 25, 2008

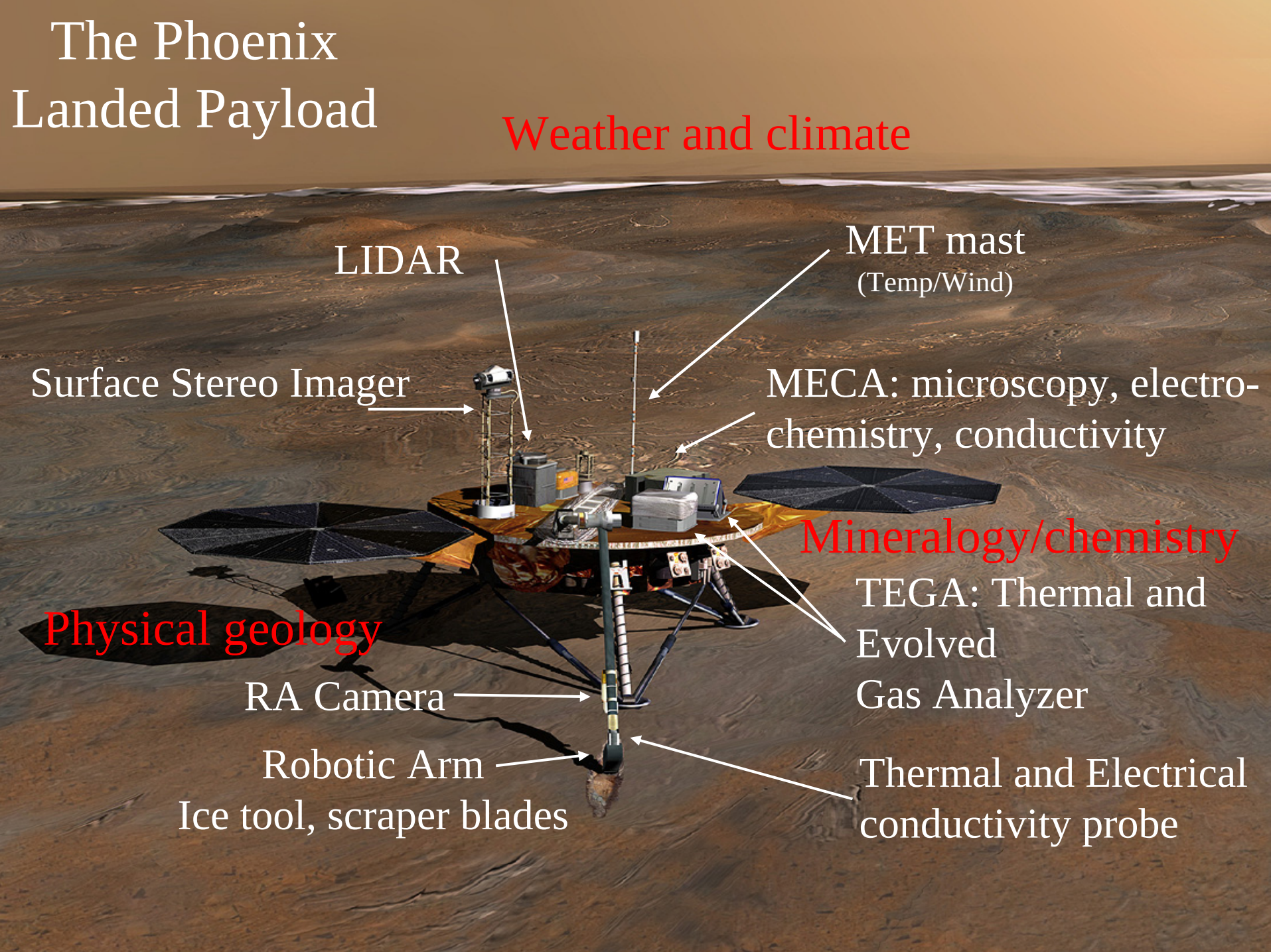
“Oh-My Gosh”

Not to worry, we landed 22 km away from the rim!

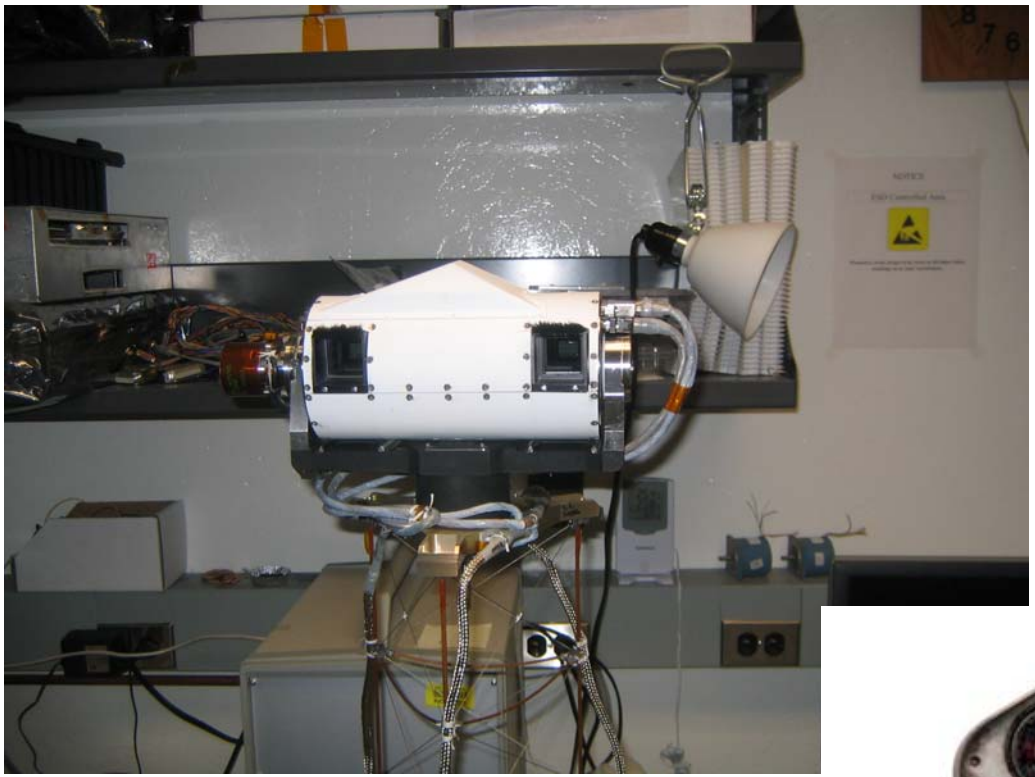
Family Portrait



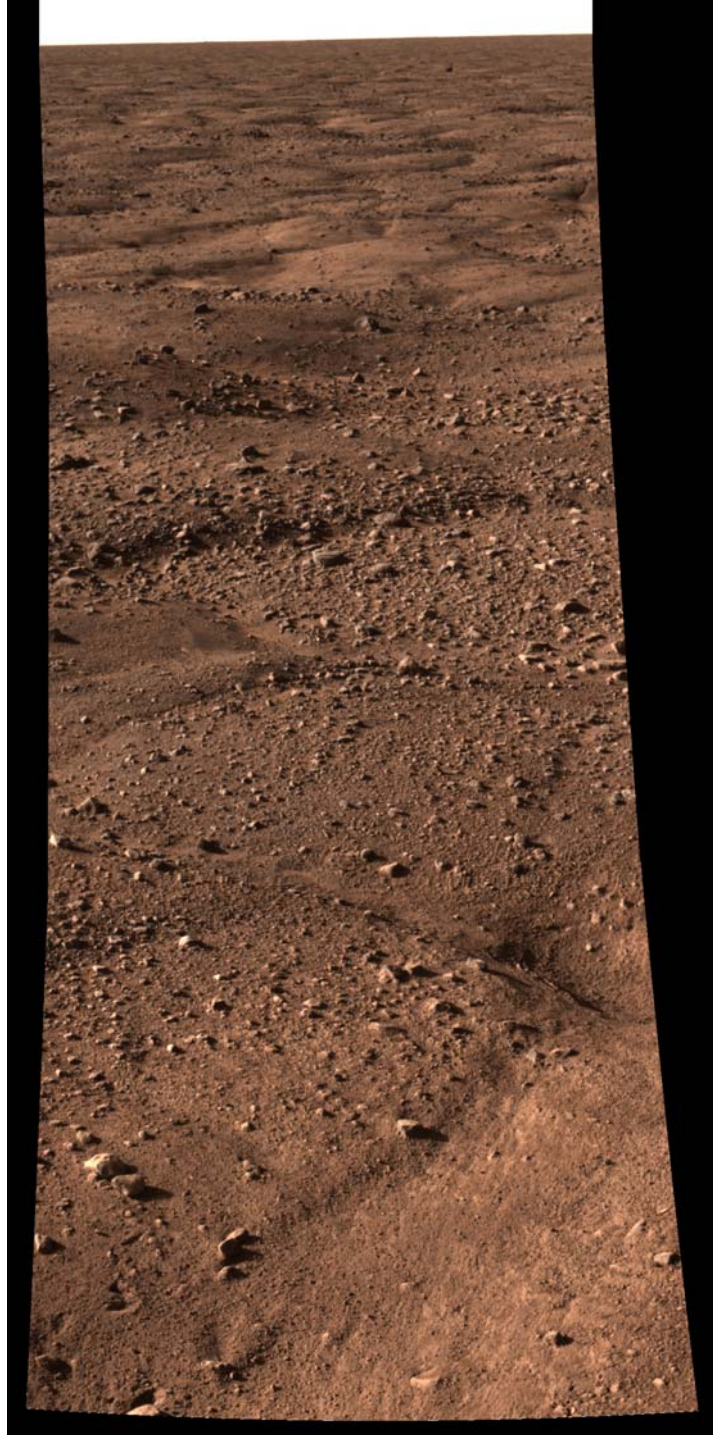
The Phoenix Landed Payload



Surface Stereo Imager



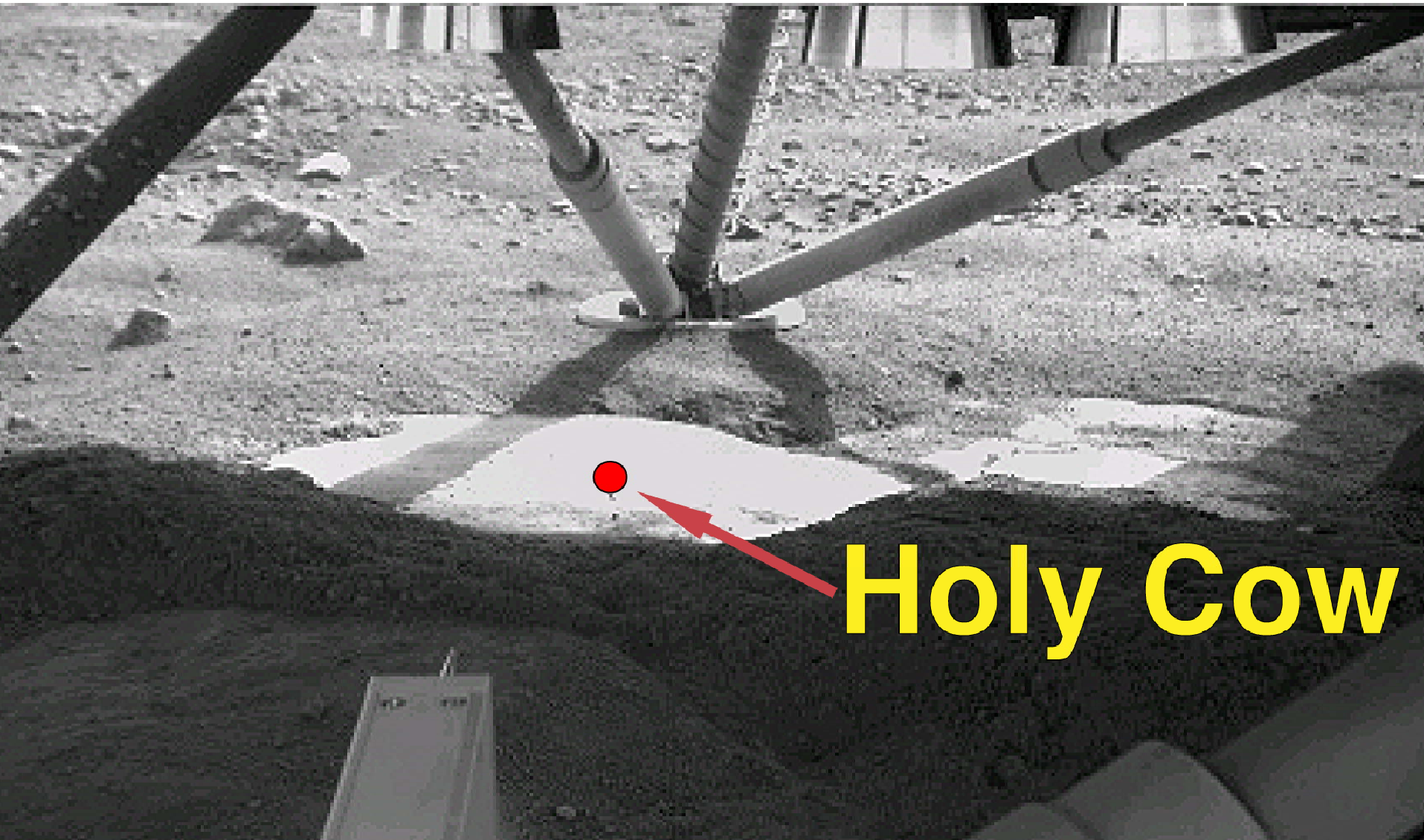
Sol 0 Images



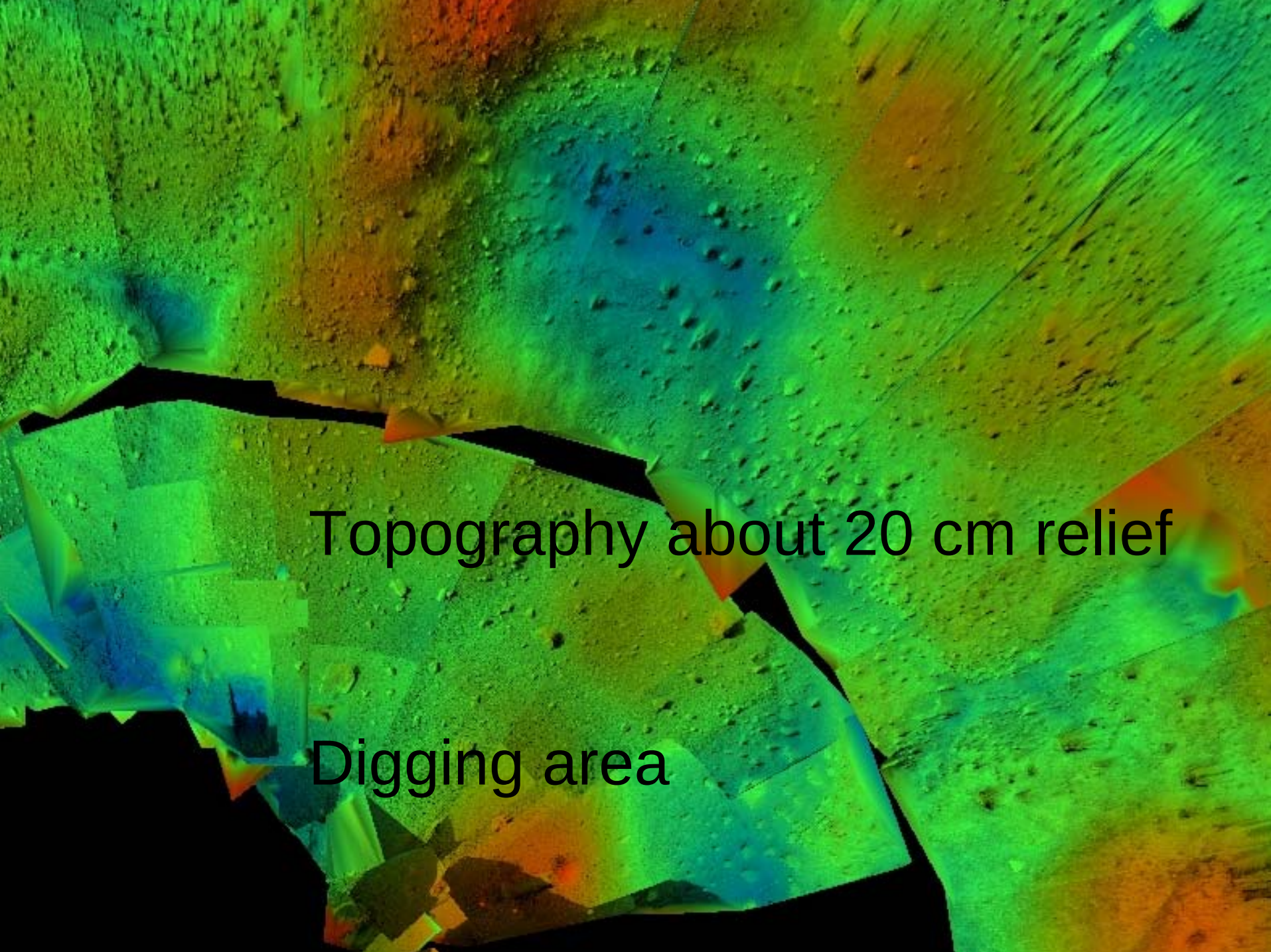
Viking Footpad--sol 1

First Ground View of the Mars Polar Region

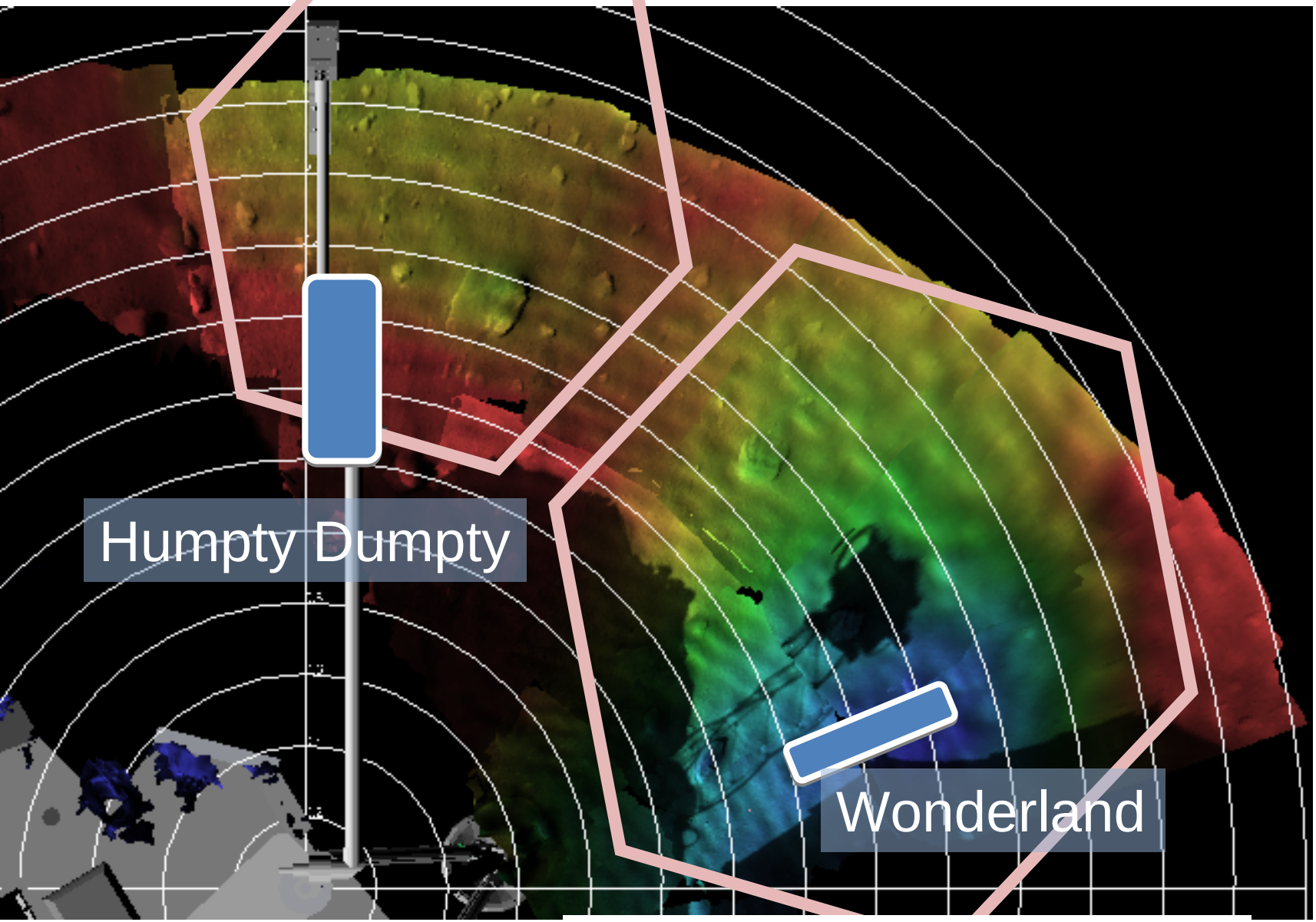
“Holy Cow” Exposed by Rocket Exhaust Under Lander



Ice Exposed Under Thrusters


Topography about 20 cm relief
Digging area

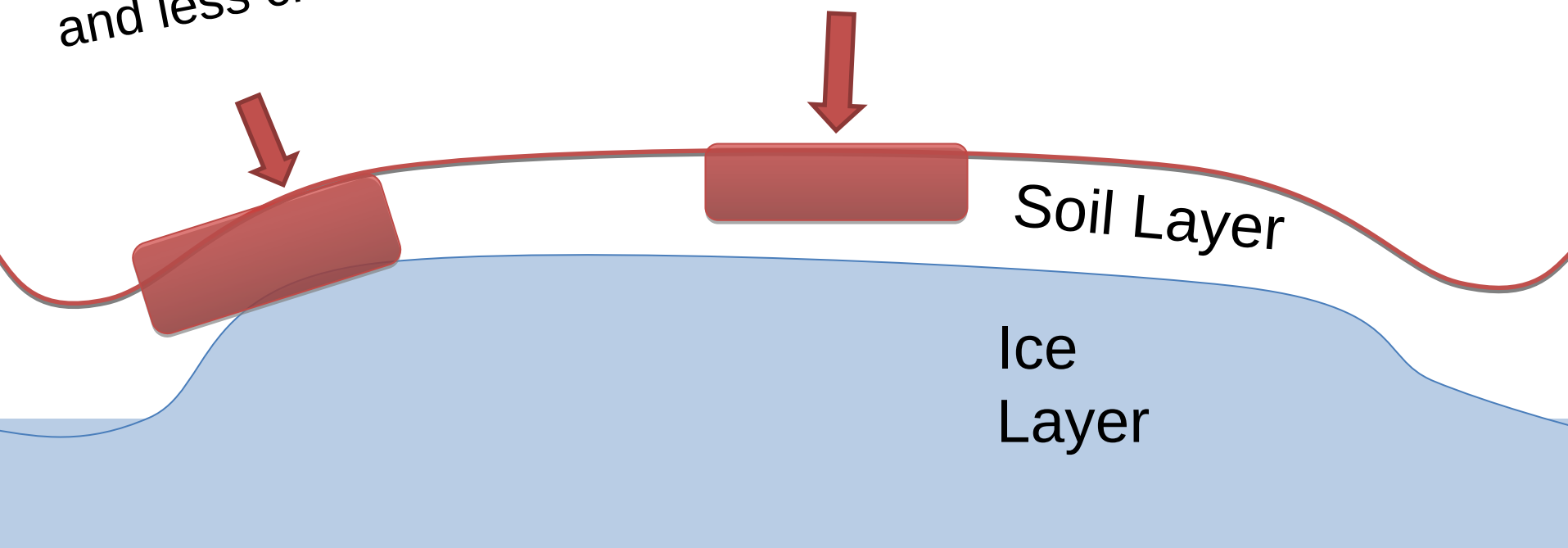
Workspace Polygons and Sampling



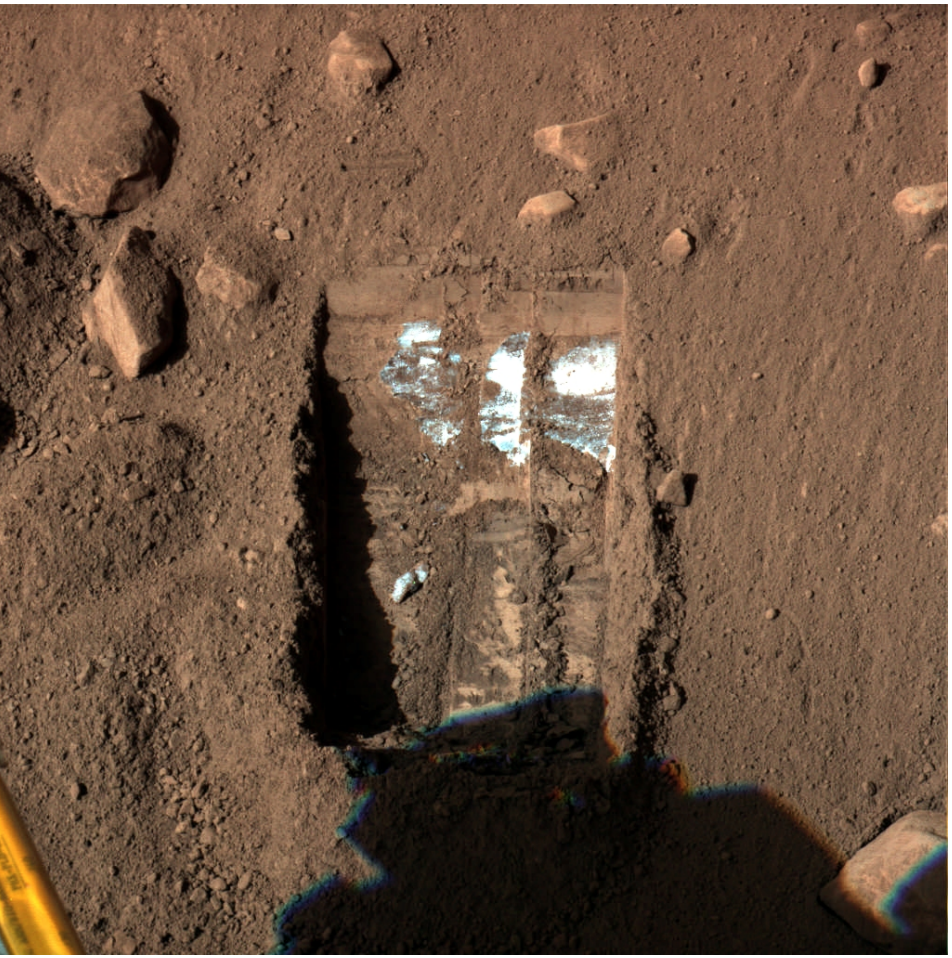
Model Polygon Cross-Section

Dodo-Goldilocks trench has exposed light-toned material and less cloddy soil

Snow White trench has exposed cloddier soil than Dodo-Goldilocks

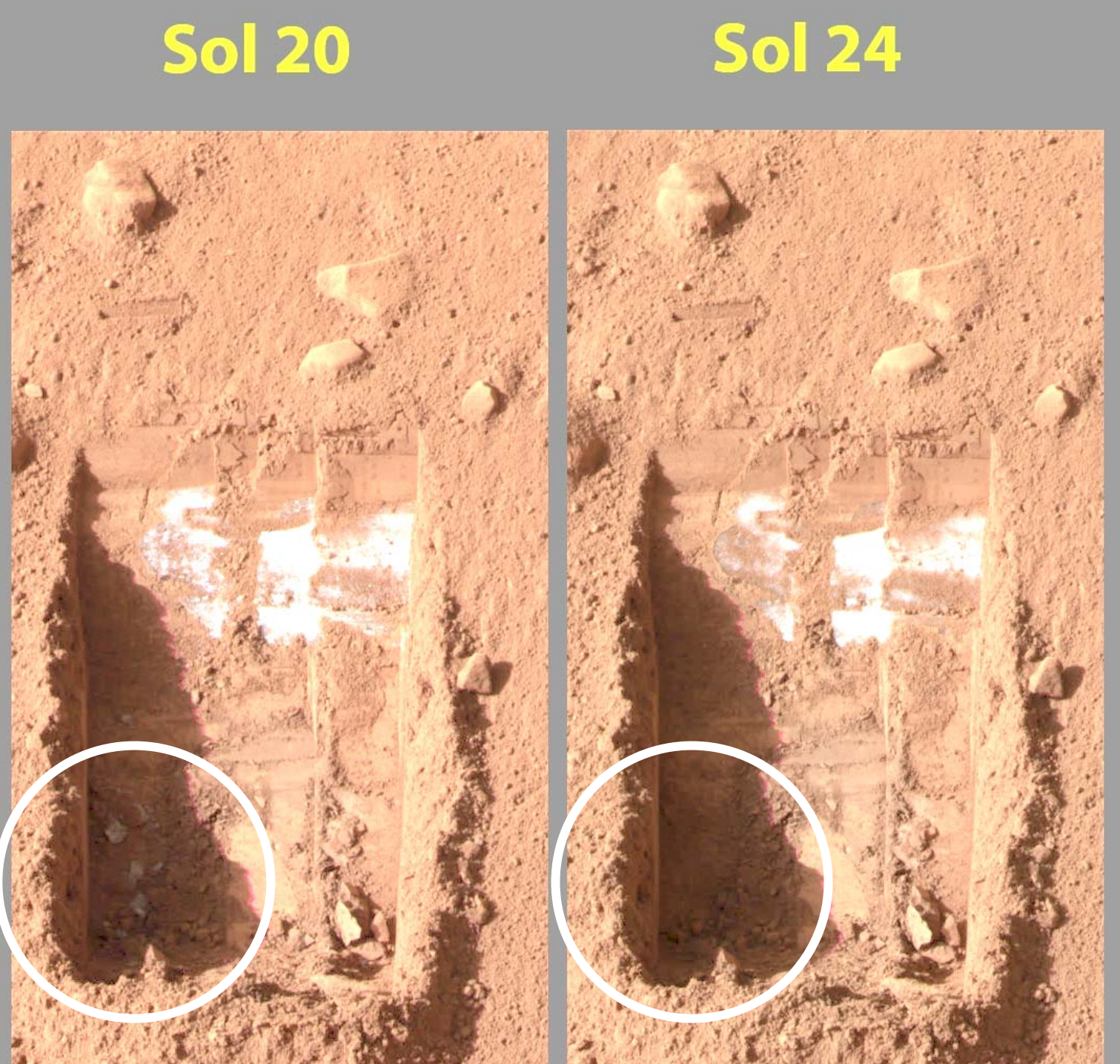


Ice-Bottomed Trenches



Dodo-Goldilocks

Snow White



Ice Chunks Sublime

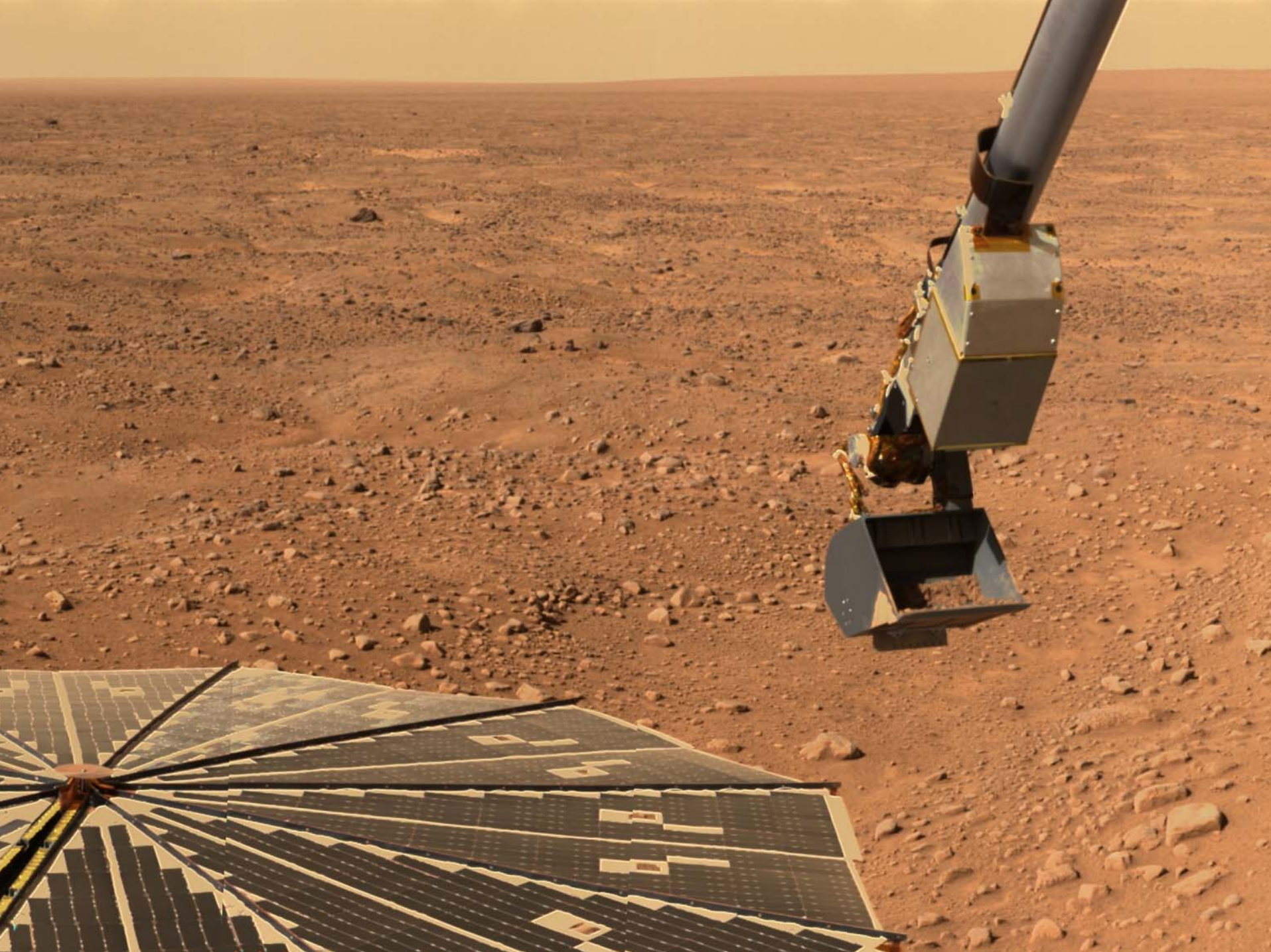
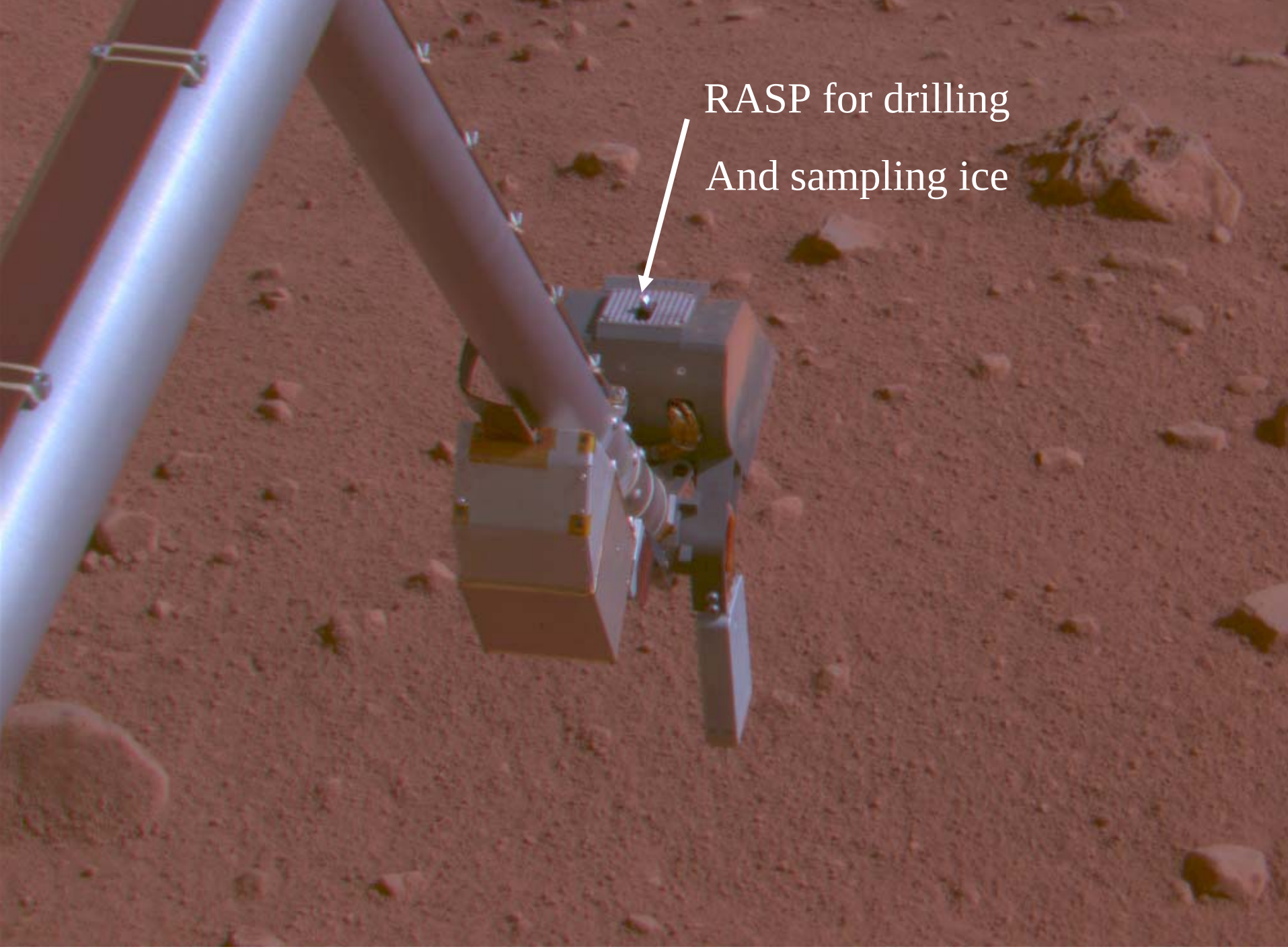
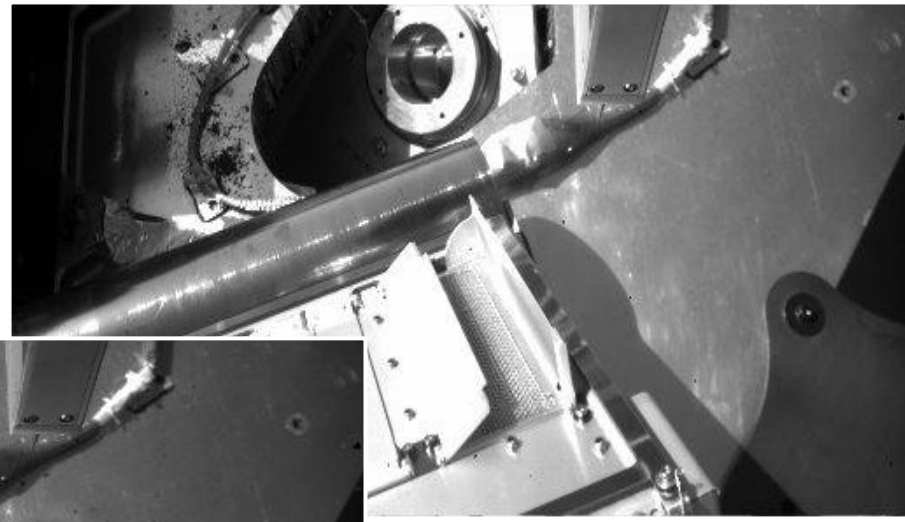


Image of Scoop
Notice Icy Soil


RASP for drilling
And sampling ice


Snakebite
Snow White trench

TEGA



TEGA Results

- No ice in surface sample
- Ice at 5 cm depth
- Volatiles released
  - CO_2 and H_2O
  - $200<T<1000°$ C
- Definitely finding minerals created in liquid water environment
  - May have blown in from another location

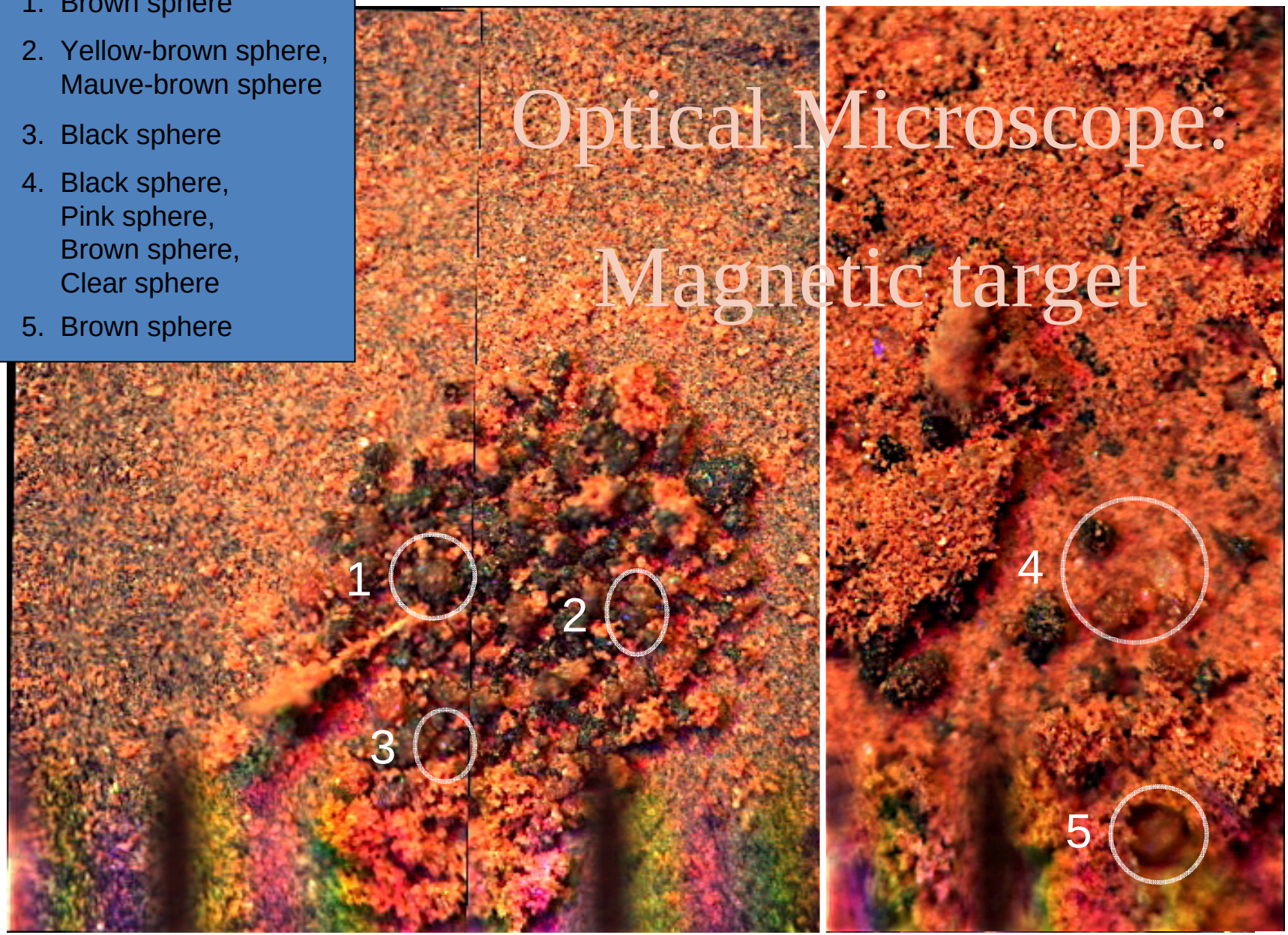

Poised for MECA
Wet Chemistry
Delivery

Wet Chemistry Results

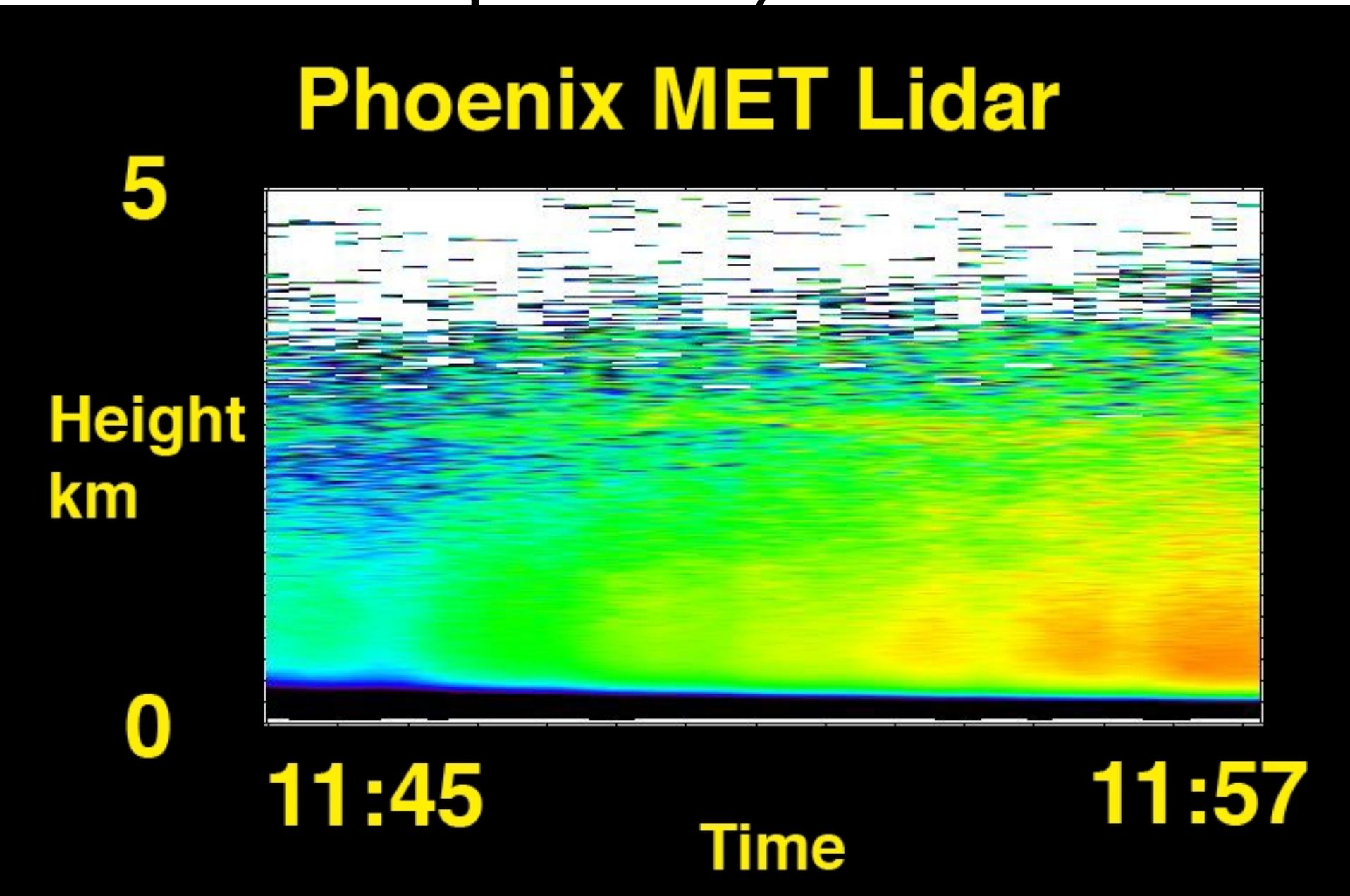
- Alkaline soil
- Small amounts of Na, K, Ca, Cl, Mg
- Larger abundance of perchlorate
  - If concentrated lowers freezing point of water to -70 C
  - Perchlorate-reducing microbes are found on Earth
  - May form in upper atmosphere and be common on Mars
- No sulfates!

1. Brown sphere
2. Yellow-brown sphere, Mauve-brown sphere
3. Black sphere
4. Black sphere, Pink sphere, Brown sphere, Clear sphere
5. Brown sphere

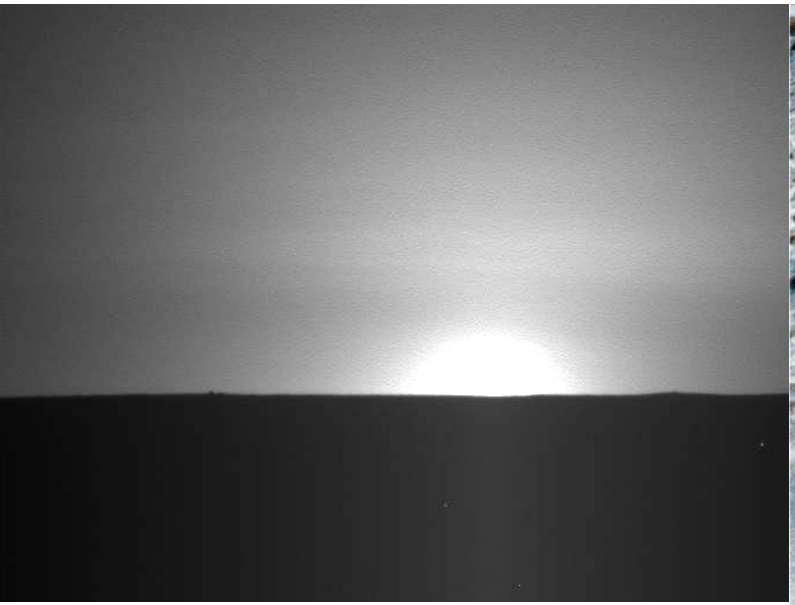
Optical Microscope: Magnetic target

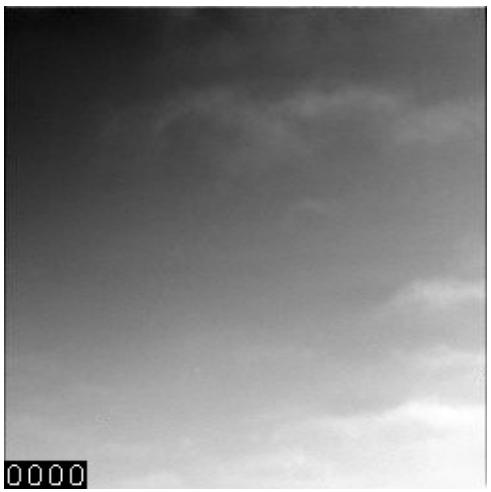


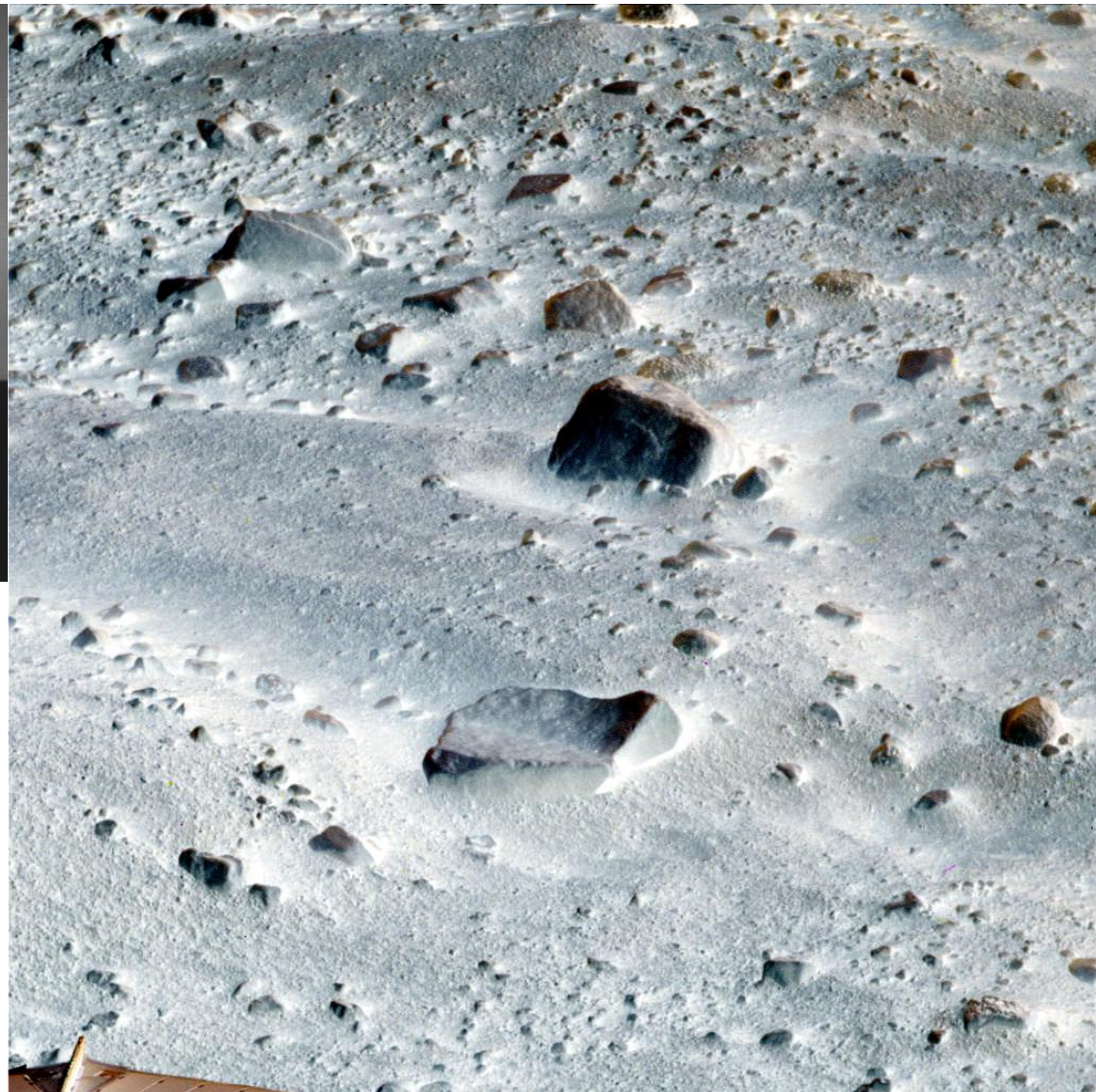
Multiple Daily Scans



Winter is Approaching



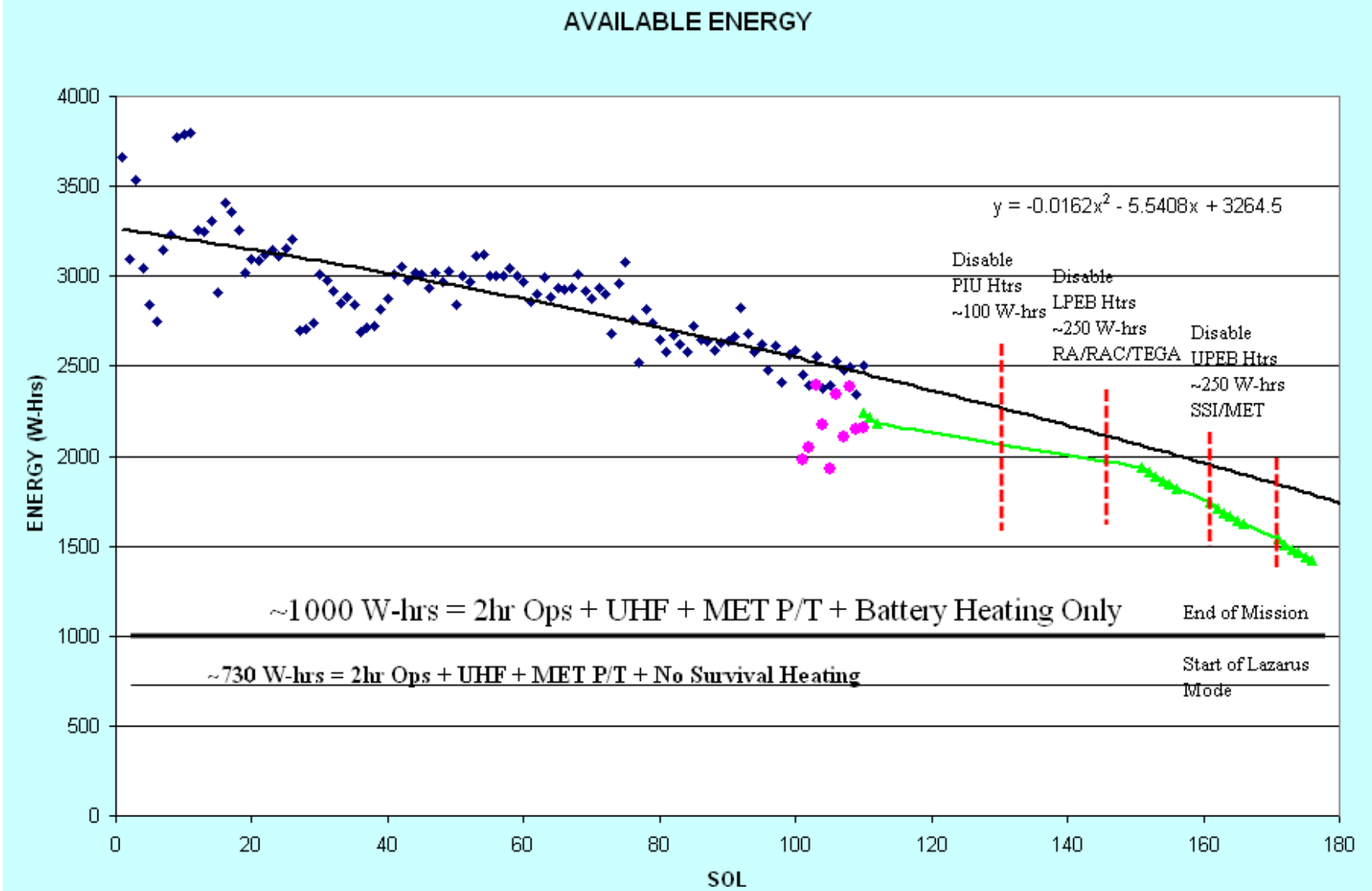




Habitability??

- Pro
  - Energy source
    - ClO^{4-}
    - Sunlight
  - Liquid water
    - Altered minerals
    - Salts
    - pH8-8.5
  - Nutrients
    - Organics??
    - Na,K,Mg,Ca
- Con
  - Hyperarid soils with ClO^{4-}
  - No indication that water has modified the local soil, material may have blown in or been created during the impact
  - Salt content minor
  - No clear organic signatures

–Energy Available vs Used



And Miles to go …

- TEGA
  - Measure the D/H in ice and water vapor
  - Identify the terrestrial organic contamination level using our organic free blank
  - Compare two ice types
- Microscopy
  - Look at grain differences from polygon center to trough, surface to depth
- Expose cross section of ice table

Final Acts

- The Phoenix weather station will monitor Winter approach until the spacecraft ceases to function
- Pictures will hopefully contain the first deposits of CO2 ice

The Phoenix Mission:

Bravely continuing its research as Winter approaches

Follow on Mission

- Phoenix investigates the ice surface and soil above it
- A mission with a drill corer could sample the entire ice column
  - How deep is the ice?
  - Profile the isotopic ratios with depth (history)
  - Are there ash layers (volcanic events)?

Exploring Mars: The Phoenix Mars Scout Mission